

5.3. Filtration Systems

5.3.1. Aqua-Filter™ Stormwater Filtration System

General Description

The AquaFilter™ Stormwater Filtration System is an in-line stormwater filtration system, which includes a Swirl Concentrator followed by a Filtration chamber with cellulose filter media. Stormwater enters the Swirl Concentrator™ by means of a tangential inlet pipe that induces a circular flow pattern. The swirling action encourages solids to drop out of the chamber, thereby preventing resuspension. A baffle plate located in front of the outlet to the Swirl Concentrator™ traps free-floating oil and debris. The pretreated flow then enters the filtration chamber where it is distributed across the filter media and allowed to permeate.



Site Considerations

The AquaFilter™ System is designed to target and remove fine sediments, free-floating oil and debris, soluble and insoluble hydrocarbons (oil and grease), phosphorus and nitrogen, volatile organic compounds, PCB's, and various organically bound heavy metals (i.e. lead, copper, zinc, chromium).

The AquaFilter™ System is capable of treating large flow rates. Larger, less frequent storms (i.e. 2-year, 10-year, or 25-year) are treated in the Swirl Concentrator™, and then allowed to partially by-pass the filter media internally beneath the filter bed. Standard AquaFilter™ models are summarized below in Table 5.8.

Table 5.8. AquaFilter™ standard models.

AquaFilter™ Model	Peak Design Flow (cfs)	Approx. Area Treated (acres)	Diameter(ft)
AF-4.5	3.5	0.5-1.0	3
AF-6	5.0	1.0-2.0	4
AF-7	7.5	2.0-3.0	6
AF-8	11.0	3.0-4.5	8
AF-9	14.5	4.5-6.0	9

Installation

The AquaFilter™ System is made of lightweight High-Density Polyethylene (HDPE) material, and can be off-loaded without the need of special lifting equipment. Because the initial stage of the AquaFilter™ System incorporates a Swirl Concentrator™, no pretreatment is required prior to the system. The Swirl Concentrator™ acts as a pretreatment device for removing coarse/fine sediment and free-floating oil and debris.

Maintenance

A routine inspection and maintenance program is recommended by the manufacturer and should be established for each unit based on the volume or load of the contaminants of concern, the frequency of releases of contaminants, and the nature of the area being drained. Over time the filter media changes color as it accumulates pollutants, allowing for inspection from the surface. When the media's color changes from tan to black, it needs to be replaced.

Pretreatment Chamber: The Swirl Concentrator™ is inspected from the surface. Free-floating oil and debris is observed by removing the manhole cover. Sediment depth is determined by lowering a measuring device to the top of the sediment pile.

Filtration Chamber: 30-inch diameter manholes are spaced over the entire filter bed providing access for inspection and removal of the filter media. Filter media is replaced by removing spent bags and positioning replacement filter bags into the filter bed.

AquaShield™ offers a complete maintenance package. Included in the maintenance services is a full inspection program (typically quarterly). If the field inspection shows that either the unit needs cleaning or the filter media needs to be replaced, a maintenance crew will be sent to the site to perform appropriate maintenance. A written report can be submitted to the regulating agency based upon the inspection observations and what, if any maintenance was performed.

Aesthetics, Community and Safety

Concerns regarding aesthetics, community support, and safety are highly site specific. For further information refer to Chapter 2, Decision Criteria.

Cost

The average cost of the AquaFilter™ Concentrator is based on the size of the unit and the treatment capacity. The standard units are priced according to size and range from \$25,000 to \$69,000 per unit. The average cost of replacement filter bags is \$45 per bag.

Performance and Verification Ranking

Verification Ranking: 

AquaShield, Inc. has and is continuing to participate in both manufacturer and independent testing of controlled laboratory and uncontrolled field conditions for technology performance effectiveness in removing pollutants found in stormwater runoff. The performance of the AquaFilter™ System technology has recently been verified by the California Environmental Protection Agency's Environmental Technology Certification Program (cert. #00-03-001) for the removal of 90% - 95% of dissolved petroleum and oils. Third party monitoring of the AquaFilter™ system showed removal rates of up to 88.9% TSS, 98.9% dissolved petroleum and oils, and reductions in phosphorus and nitrogen.

Studies:

- *AquaShield System*. Analytical Industrial Research Laboratories, Inc. September 1997.
- Environmental Technology Evaluation Center (EvTEC) through the Civil Engineering Research Foundation (CERF) of the American Society of Civil Engineers (ASCE)
- U.S. EPA/NSF International – Wet Weather Flow Technologies Pilot (WWF) of the Environmental Technology Verification (ETV) Program

- California EPA – Environmental Technology Certification Program (ETC) or CalCert
- U.S. Navy Environmental Leadership Program (NELP)
- City of Los Angeles, CA – Dept. of Public Works, Stormwater Management Division – TEA 21 Urban Stormwater Management Program
- City of Chattanooga, TN, Dept. of Public Works, Stormwater Management Division
- City of Jackson, WY, Dept. of Public Works, Stormwater Management Division

Installation Contact

No existing New Hampshire installations to date.

Location: DPW Yard, Wayne, MI

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5.3.2. StormFilter™

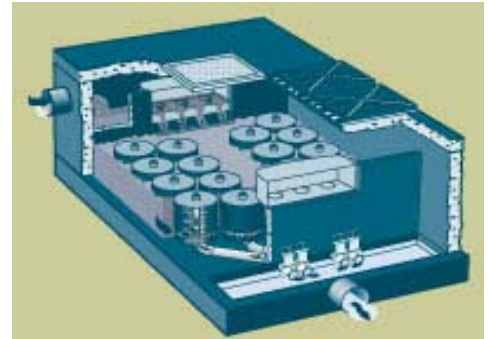
General Description

The StormFilter™ is a passive, flow-through stormwater filtration system that utilizes rechargeable filter cartridges. The siphon-driven cartridges, which draw stormwater through the filter media, are installed in precast or cast-in-place concrete vaults with pipe underdrains cast into the concrete floor.

Site Considerations

The StormFilter™ system is designed to remove total suspended solids (TSS), soluble metals, soluble phosphorus, nitrates, and oil and grease through mechanical filtration, ion exchange, and adsorption. The StormFilter™ has the option of filter media, which is selected based on the target pollutants at the site. Specific potential applications include:

- Fast food and shopping mall parking areas
- Medical facilities
- Light industrial developments
- Arterial roadways
- Residential roadways
- Freeway systems
- Waste transfer stations



The StormFilter™ is sized to treat the peak flow of a water design storm as it passes through the system. The number of filter cartridges required to treat the peak water quality flow determines the particular size of a system. Each cartridge is designed to treat a peak flow of 15 gpm (30 cartridges/cfs). The StormFilter™ cartridge is the primary treatment device within the system. The cartridges are filled with various media depending on individual site conditions. The five types of media are described below:

CSF® Leaf Media: From pure deciduous leaves, composted, and pelletized.

Granular Activated Carbon (GAC): From a coal based media.

Iron-Infused Media: From an open cellular porous foam media that contains iron within its structure.

Perlite: From a naturally occurring volcanic ash, expanded rapidly by heat.

Zeolite: From naturally occurring Clinoptilolite.

Pleated Fabric Insert: Constructed from 75 feet² of polyester material with pore openings of either 37 or 70 microns.

Installation

Stormwater Management provides a full range of engineering services for the design of the StormFilter™. Stormwater Management also provides all components to the StormFilter™, cartridge installation, and final observation. In addition, Stormwater Management provides long-term support and maintenance to the land owner/operator.

The StormFilter™ typically requires 2.3 feet of head differential between the invert of the inlet and the invert of the outlet. Detailed construction specifications are available from the manufacturer. Pretreatment needs vary depending on site characteristics. Examples of upstream practices include:

- Pavement sweeping and other source control measures
- Trapped and sump catch basins
- Detention ponds, vaults, or pipes
- Sediment forebays
- Oil-water separators and hydrodynamic devices

Maintenance

Inspections are recommended during the mid-season to determine the system loading. Annual maintenance is recommended, and should be incorporated into the stormwater management plan for the entire site. Typical maintenance involves sediment removal and cartridge removal and recharging as necessary. Operations and maintenance guidelines are available from Stormwater Management. The company also provides maintenance services, site assessments, and notification to regulatory agencies when the units are maintained and are in compliance. Stormwater Management can provide full maintenance (sediment removal from entire vault, replacement of existing cartridges with recharged cartridges, sediment and media disposal, and letter and certificate of compliance) at an average cost of \$100 per cartridge. Structural design is on the order of 50 years. Cartridge life is guaranteed as long as maintenance contract is upheld. The typical life of a cartridge is 20 years.

Aesthetics, Community and Safety

Concerns regarding aesthetics, community support, and safety are highly site specific. For further information refer to Chapter 2, Decision Criteria.

Cost

System costs vary depending on structural needs, depth, type of lid, and other factors. A 6' x 12' StormFilter™ (filters a flow-through volume of 0.3 cfs) will cost approximately \$15,000. An 8' x 18' StormFilter™ (filters a flow-through volume of 0.8 cfs) will cost approximately \$30,000. Larger units, capable of filtering flow-through volumes of greater than 0.8 cfs, range in price from \$30,000 to \$200,000.

Performance and Verification Ranking

Verification Ranking: ●●●●

Independent and laboratory studies have been conducted on the StormFilter™ system and are available from the Stormwater Management website. Data include removals of TSS, ortho-phosphorus, oil and grease, total phosphorus, soluble metals such as copper and zinc, and other pollutants such as pentachloro-phenol. Water characterization studies are available for specialized applications.

Studies:

- *Stormwater Sampling – StormFilter Performance Results*. Burwell/Straley's Union 76 Station, Bremerton, Washington. EnCo Environmental Corporation April 2001 – August 2001.

Installation Contact

No existing New Hampshire installations to date. For contact information of installations outside of New Hampshire and for updates please contact Stormwater Management, Inc.

Additional Installations:

California	Kansas	North Carolina	Washington
Colorado	Maryland	Ohio	Washington, DC
Delaware	Montana	Oregon	
Florida	New Jersey	Vermont	
Idaho	New Mexico	Virginia	

Manufacturer

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